

Patent Claims

1. A method for cleaning at least one process chamber (7) for coating at least one substrate (3), in particular made from glass,

characterized in that the at least one process chamber (7) is purged with a conditioned purge gas (15) prior to a coating operation.

2. The method as claimed in claim 1, in which the moisture content of the purge gas, before it enters the at least one process chamber (7), is set to a predetermined moisture level, in particular to a relative moisture content of at most 30%, in particular at most 25%, preferably at most 10% or even at most 5%.

3. The method as claimed in claim 1 or claim 2, in which the purge gas, before it enters the at least one process chamber (7), has foreign substances removed from it, in particular by filtering.

4. The method as claimed in one or more of the preceding claims, in which the temperature of the purge gas, before it enters the at least one process chamber (7), is set in at least a predetermined temperature range, preferably to at least a predetermined temperature value, in particular in a temperature range between 20°C and 90°C, preferably in a temperature range between 60°C and 80°C.

5. The method as claimed in one or more of the preceding claims, in which the pressure of the purge gas, before it enters the at least one process chamber (7), is set to at least a predetermined pressure value, preferably in a pressure range between 0.8 bar and 1.5 bar.

6. The method as claimed in one or more of the preceding claims, in which the purge gas used is air, in particular ambient air, and/or an inert gas.

7. The method as claimed in one or more of the preceding claims, in which during a cleaning operation the conditioned purge gas (15) flows, preferably continuously, through the at least one process chamber (7), and/or at least one cleaning step is carried out by flooding the process chamber (7) with conditioned purge gas (15) and then discharging the purge gas (16).

8. A method, in particular the method as claimed in one or more of the preceding claims, in which, during a or the cleaning operation, a pressure lock which is arranged at an entry and/or an exit of at least one process chamber (7) for coating at least one substrate (3), in particular made from glass, is purged with conditioned purge gas or the conditioned purge gas (15).

9. The method as claimed in one or more of the preceding claims, in which, for pressure equalization in the pressure lock, conditioned purge gas (15) flows into the pressure lock and/or in which the pressure lock, before the at least one substrate (3) passes into the pressure lock and/or while the at least one substrate (3) is in the pressure lock, is purged with conditioned purge gas (15).

10. The method as claimed in one or more of the preceding claims, in which the purge gas is mixed from various gas streams.
11. The method as claimed in one or more of the preceding claims, in which the purge gas is passed through a circuit.
12. The method as claimed in claim 11, in which the purge gas (16) which emerges from the at least one process chamber (7) is conditioned with regard to the moisture content and/or the loading with foreign substances and/or the temperature and/or the pressure and/or the gas composition.
13. The method as claimed in one or more of the preceding claims, in which the at least one substrate (3) is pretreated in a substrate treatment operation which precedes the coating operation, in particular in a substrate drying operation (1) preceded by a substrate washing operation (22).
14. The method as claimed in claim 13, in which at least some of a conditioned drying gas (5) for drying the at least one substrate in the substrate drying operation (1) and/or at least some of a drying gas (19) which is discharged from the substrate drying operation (1) is at least partly used as conditioned purge gas (15).
15. The method as claimed in one or more of the preceding claims, in which the at least one process chamber (7) is at least partially heated, preferably from the outside, in particular at least part of at least one process chamber wall, before and/or during a cleaning operation.

16. The method as claimed in claim 15, in which the at least one process chamber (7) is heated at least in part to a temperature between 20°C and 60°C, in particular between 40°C and 60°C, in particular inductively and/or by radiation and/or by heat conduction.
17. The method as claimed in one or more of the preceding claims, in which at least one pulse generator device (23), before and/or during a coating operation, transmits at least one mechanical pulse to a process chamber wall, in particular an outer wall (28), of the at least one process chamber (7).
18. The method as claimed in claim 17, in which as pulse generator device (23) at least one hammer and/or at least one compressed-air nozzle and/or at least one vibration unit and/or at least one ultrasound generator is used.
19. The method as claimed in one or more of claims 17 to 18, in which the mechanical pulse is triggered automatically as a function of at least one process variable and/or the strength of the mechanical pulse is set as a function of a degree of contamination.
20. The method as claimed in one or more of claims 17 to 19, in which at least some of the purge gas (16) which emerges from the at least one process chamber (7) is used to generate the mechanical pulse.

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A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1090 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

21. An apparatus for cleaning at least one process chamber (7) for coating at least one substrate (3), in particular made from glass, in particular for carrying out the method as claimed in one or more of the preceding claims, characterized in that at least one purge device is provided for introducing a conditioned purge gas (15) into the at least one process chamber (7) and/or for passing a conditioned purge gas (15) through the at least one process chamber (7) prior to a coating operation.
22. The apparatus as claimed in claim 21, in which the at least one purge device comprises at least one purge gas feed line and at least one purge gas delivery unit (14, 17), in particular a pump and/or a fan, which are arranged upstream and/or downstream of the at least one process chamber (7) as seen in a direction of flow.
23. The apparatus as claimed in claim 21 or claim 22, in which at least one conditioning device (9, 11, 13, 14) is provided for conditioning the purge gas before it enters the process chamber (7).

24. The apparatus as claimed in claim 23, in which at least one conditioning device (11) is provided for the purpose of setting a moisture content of the purge gas, in particular in the form of an adsorption unit or a cooling unit, preferably an absorption refrigeration machine, and/or

in which at least one conditioning device (13) is provided for setting a temperature of the purge gas, in particular in the form of a heating device, and/or

in which at least one conditioning device (14) is provided for setting a pressure of the purge gas, in particular in the form of a compressor, and/or

in which at least one conditioning device (9) is provided for separating foreign substances out of the purge gas, in particular in the form of a filter unit.

25. An apparatus, in particular the apparatus as claimed in one or more of claims 21 to 24, in which at least one feed device is provided for introducing conditioned purge gas or the conditioned purge gas (15) into at least one pressure lock which is arranged at an entry of a process chamber (7) for coating at least one substrate (3), in particular made from glass, and/or at an exit of a process chamber for coating at least one substrate (3), in particular made from glass, and/or for passing conditioned purge gas or the conditioned purge gas (15) through the at least one pressure lock, and/or in which at least one discharge device is provided for discharging the purge gas from the at least one pressure lock.

26. The apparatus as claimed in one or more of claims 21 to 25, in which at least one heating device is provided for the purpose of heating at least part of at least one process chamber (7) before and/or during a cleaning operation, which is preferably arranged outside the process chamber (7).

27. The apparatus as claimed in one or more of claims 21 to 26, in which at least one pulse generator device (23) is provided, which prior to a coating operation imparts at least one mechanical pulse to a process chamber wall, in particular an outer wall (28), of the at least one process chamber.

28. The apparatus as claimed in one or more of claims 21 to 27, in which the at least one pulse generator device (23) comprises at least one hammer and/or at least one compressed-air nozzle and/or at least one vibration unit and/or at least one ultrasound generator and/or at least one control unit.

29. The apparatus as claimed in one or more of claims 21 to 28, in which there is at least one means for determining process variables, in particular for detecting a degree of contamination in the process chamber.

30. The apparatus as claimed in one or more of claims 21 to 29, in which the at least one conditioning device (9, 11, 13, 14) is at least one conditioning device (9, 11, 13, 14) of a substrate treatment apparatus connected upstream of the at least one process chamber, in particular of a substrate drying apparatus (1) with upstream substrate washing apparatus (22).

31. The apparatus as claimed in claim 30, in which there is at least one device for introducing at least some of a drying gas (19) which emerges from the substrate drying apparatus and/or at least some of a drying gas (5) which has been prepared in the at least one conditioning device into the process chamber (7) as at least part of the conditioned purge gas (15).

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60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

32. A method for coating at least one substrate, in particular made from glass, in a process chamber, in which the process chamber (7), prior to a coating operation, is cleaned by a method as claimed in one or more of claims 1 to 18 and/or using an apparatus as claimed in one or more of claims 19 to 28.

33. The method as claimed in claim 32, in which after the cleaning operation the pressure in the process chamber (7) is reduced with respect to the ambient pressure, preferably to between 10^{-7} bar and 10^{-3} bar, and then a coating process is initiated, in particular a coating process from the vapor phase, preferably a PVD or CVD process.

34. An apparatus for coating at least one substrate, in particular made from glass, in a process chamber (7), in particular for carrying out the method as claimed in claim 29 or claim 30, comprising a separate apparatus for cleaning the process chamber (7) prior to a coating operation by purging with a conditioned purge gas (15), in particular an apparatus as claimed in one or more of claims 19 to 28.